

Amendments to the Claims

The following Listing of Claims replaces all prior versions, and listings, of claims in the application.

Listing of Claims:

Claims 1 and 2 (canceled)

Claim 3 (previously presented): An optoelectronic device, comprising:

an optical device system comprising an optical device substrate supporting one or more optical devices and a solderable metallization pattern having a spatial arrangement with respect to the one or more optical devices;

an optical lens system comprising one or more optical lenses and a device bonding surface supporting a solderable metallization pattern having a spatial arrangement with respect to the one or more optical lenses, wherein the one or more optical lenses are recessed below the device bonding surface; and

a plurality of solder bumps disposed between the metallization patterns of the optical device system and the optical lens system;

wherein the plurality of solder bumps bond the optical device substrate to the device bonding surface with the one or more optical devices aligned with the one or more optical lenses.

Claim 4 (previously presented): An optoelectronic device, comprising:

an optical device system comprising an optical device substrate supporting one or more optical devices and a solderable metallization pattern having a spatial arrangement with respect to the one or more optical devices;

an optical lens system comprising one or more optical lenses incorporated into an optical substrate bonded to a spacer substrate having a device bonding surface supporting a solderable metallization pattern having a spatial arrangement with respect to the one or more optical lenses; and

a plurality of solder bumps disposed between the metallization patterns of the optical device system and the optical lens system;

wherein the plurality of solder bumps bond the optical device substrate to the device bonding surface with the one or more optical devices aligned with the one or more optical lenses.

Claim 5 (previously presented): The optoelectronic device of claim 4, wherein a wafer bond bonds the optical substrate to the spacer substrate.

Claim 6 (previously presented): The optoelectronic device of claim 4, wherein a solder bond bonds the optical substrate to the spacer substrate.

Claim 7 (original): The optoelectronic device of claim 4, wherein the thickness of the spacer substrate is selected based upon a representative focal distance between the one or more optical devices and the one or more optical lenses.

Claim 8 (original): The optoelectronic device of claim 4, wherein the spacer substrate comprises one or more apertures through which light is transmitted between the one or more optical devices and the one or more optical lenses.

Claim 9 (original): The optoelectronic device of claim 4, further comprising an integrated circuit formed on the spacer substrate and configured to drive the one or more optical devices.

Claim 10 (previously presented): The optoelectronic device of claim 4, further comprising an integrated circuit bonded to the spacer substrate by a flip-chip solder bond and configured to drive the one or more optical devices.

Claim 11 (previously presented): An optoelectronic device, comprising:
an optical device system comprising an optical device substrate supporting one or more optical devices and a solderable metallization pattern having a spatial arrangement with respect to the one or more optical devices;

an optical lens system comprising one or more optical lenses and a device bonding surface supporting a solderable metallization pattern having a spatial arrangement with respect to the one or more optical lenses; and

a plurality of solder bumps disposed between the metallization patterns of the optical device system and the optical lens system, wherein the plurality of solder bumps bond the optical device substrate to the device bonding surface with the one or more optical devices aligned with the one or more optical lenses, and, wherein a characteristic dimension of the plurality of solder bumps is selected based upon a representative focal distance between the one or more optical devices and the one or more optical lenses.

Claim 12 (original): The optoelectronic device of claim 4, wherein the one or more optical devices comprises a vertical cavity surface emitting laser or a detector, or both.

Claims 13-20 (canceled)

Claim 21 (currently amended): The optoelectronic device of claim 4, wherein the one or more optical lenses are incorporated into a surface of the optical substrate ~~the device bonding surface~~.

Claim 22 (previously presented): The optoelectronic device of claim 4, wherein the one or more optical lenses are recessed below the device bonding surface.

Claim 23 (previously presented): The optoelectronic device of claim 4, wherein multiple optical lenses are cooperatively arranged in optical alignment with multiple respective optical devices.

Claim 24 (previously presented): The optoelectronic device of claim 8, wherein multiple optical devices are arranged for optical communication through multiple respective spacer substrate apertures.

Claim 25 (currently amended): An optoelectronic device, comprising:

an optical lens system comprising a lens substrate supporting one or more optical lenses, and a semiconductor spacer substrate defining one or more apertures therethrough;
and

an optical device system comprising a device substrate supporting one or more optical devices;

~~The optoelectronic device of claim 13,~~ wherein each of the spacer substrate apertures has a lens substrate opening at a surface facing the lens substrate and a device substrate opening at a surface facing the device substrate, wherein for each spacer substrate aperture the lens substrate opening is larger than the device substrate opening, and wherein the lens substrate is bonded to the spacer substrate and the spacer substrate is bonded to the device substrate with the one or more optical lenses, the one or more optical apertures and the one or more optical devices held together in registered alignment.

Claim 26 (canceled)

Claim 27 (currently amended): An optoelectronic device, comprising:
an optical lens system comprising a lens substrate supporting one or more optical lenses, and a semiconductor spacer substrate defining one or more apertures therethrough ~~The optoelectronic device of claim 13,~~ wherein multiple optical devices are arranged for optical communication through multiple respective spacer substrate apertures; and
an optical device system comprising a device substrate supporting one or more optical devices;

wherein the lens substrate is bonded to the spacer substrate and the spacer substrate is bonded to the device substrate with the one or more optical lenses, the one or more optical apertures and the one or more optical devices held together in registered alignment.

Claim 28 (previously presented): The optoelectronic device of claim 3, wherein each solder bump is in direct contact with respective metallization patterns of the optical device system and the optical lens system.

Claim 29 (previously presented): The optoelectronic device of claim 11, wherein each solder bump is in direct contact with respective metallization patterns of the optical device system and the optical lens system.

Claim 30 (canceled)

Claim 31 (previously presented): The optoelectronic device of claim 4, wherein a wafer bond bonds the optical substrate to the spacer substrate.

Claim 32 (previously presented): The optoelectronic device of claim 4, wherein a solder bond bonds the optical substrate to the spacer substrate.

Claim 33 (previously presented): The optoelectronic device of claim 8, wherein each of the spacer substrate apertures has a lens substrate opening at a surface facing the lens substrate and a device substrate opening at a surface facing the device substrate, wherein for each spacer substrate aperture the lens substrate opening is larger than the device substrate opening.